



# ARCHITECTURE

Kansas State University

# TEAM APPROACH

## Studio Introduction

The Net Positive Studio is an interdisciplinary research and design effort in the College of Architecture, Planning, and Design at Kansas State University seeking to develop housing prototypes that are affordable, net zero, and strengthen and sustain communities. Partnering with Stafford County Economic Development (EcoDevo), a non-profit organization, the Net Positive Studio was tasked with the design of a single-family home in the rural town of St. John, Kansas. For the 2020 Solar Decathlon Build Challenge, the studio has researched and developed a design to meet the challenges St. John has been facing. The goal of the studio is to design and build a house that supports the community, providing high quality homes to replace a shrinking housing stock, while encouraging households to invest in their town. The designed prototype intends to demonstrate an innovative approach to high performance building that is both replicable and affordable, while providing a safe, high-quality and high-functioning house that is accessible to a broader spectrum of the residents.

## Studio Process

The studio began by researching the current nation-wide housing crisis, looking at issues of housing that drew from their own personal experiences with housing, and then examining the social, economic, and environmental aspects of the home. The team took a crash course in how homes are purchased and sold in the real estate system, how housing is developed and financed, how mortgages work, the process of eviction and foreclosure, and the possible barriers to housing that keep quality housing out of reach.



# TEAM APPROACH

## Engaging the St. John Community

After researching the housing problem more generally, the team spent a month of researching the housing conditions and affordability in the town of St. John, visiting the town twice and meeting with Stafford Economic Development Corporation leadership, community leaders, and town officials to learn about the context of the project. The studio identified three critical issues that their project would address: the scarcity of mortgageable homes, poor quality of existing homes, and the high cost of repairs and utilities for unimproved housing. During the research process, the studio shared findings and received feedback from faculty in the Regional and Community Planning Department at APDesign.



Because the area is losing homes at a rate of 12 homes per year, finding quality housing is a barrier that causes prospective homebuyers to look elsewhere for housing, even if they work in the community.





# TEAM APPROACH

## Engaging the St. John Community

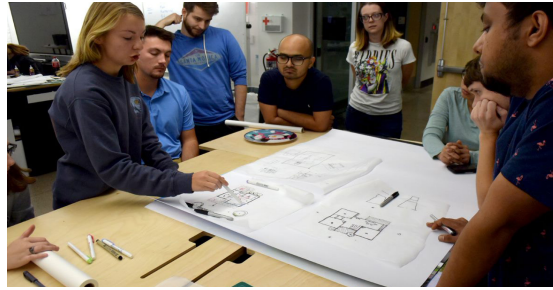
In response, the studio began work designing a home that would provide affordable, energy efficient housing that would be adapted specifically to St. John and other rural Kansas communities. Small teams of students developed six schematic designs after community and housing research was complete, and presented these schemes in an open meeting with community members. In order to gather as much feedback as possible, the students left their design presentations in the Town Hall, and residents left their comments and feedback on sticky notes. The studio visited St. John multiple times to present their research and design progress to project stakeholders, as well as students from nearby St. John high school and officials from neighboring communities.



As the design process moved forward, the team combined the most successful aspects of these earlier designs into the final design, working through a process of design development to determine the structural systems, materials, details, and MEP system design for the project, getting input from faculty in the Architectural Engineering and Landscape Architecture disciplines. The team also used energy modeling, daylight analysis, and cost analysis extensively to improve the design and ensure that project goals for affordability and net zero were met.

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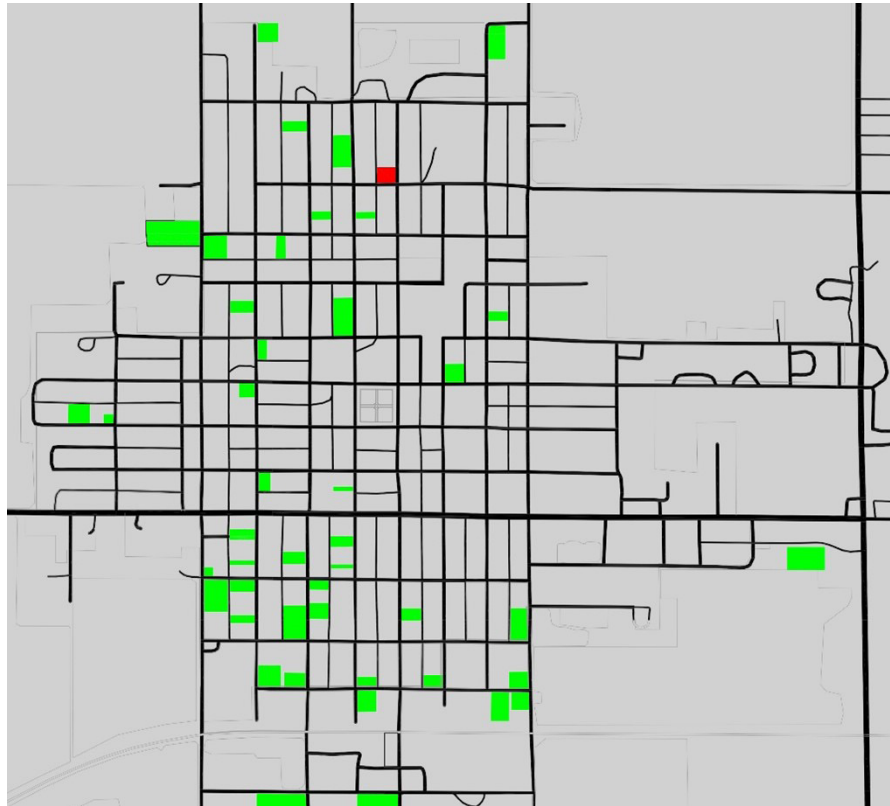
## Engaging the St. John Community



Through this process, the studio developed its own unique approach to prefabrication and continued to refine the design for construction and energy performance. The team used BIM modeling extensively to manage the design process, finalize construction documents, and prepare the project to be prefabricated.

## The Site

The proposed project site, indicated in red on the below map, is located at the intersection of Broadway Street and East 8th Street. Like many sites in St. John, this one used to have a house on it, but the home fell into disrepair, was condemned, and eventually demolished. The home to the north is also unoccupiable and targeted for future development. The selected site is a corner lot, providing an opportunity to design the prototype on one of the more important road intersections in St. John. South-facing exposure will benefit passive strategies and onsite solar energy production. Most parcels in St. John are flat with access to a road on one side and an alley on the other side, and the studio developed the prototype so that it could be successful on a variety of different lot types and configurations in town.



# STRATEGY

## Architecture

Our design sought to realize a number of concepts and values that the studio explored early on in a research phase, drawing from theories of space, user needs, and mental well-being in addition to passive design. These concepts were presented to community members in a series of meetings, where input was incorporated into the evolving designs. Overall, we strived to use this research to inform design decisions towards a home that will provide its users with strong mental, physical, and emotional health as well as providing robust energy performance in an affordable build. The following concepts were established based on St. John's need:

- Central Social Space
- Creating Privacy Without Isolation
- Hierarchy and Outdoor spaces
- Simple form
- Modularity and Repetition





# STRATEGY

## Central Social Space

A large central volume containing the living room, kitchen, and dining area provides ample space and flexibility for its residents. The central core is also connected spatially and visually to outdoor spaces.

## Creating Privacy without Isolation

The bedrooms on either side of the central space create two private zones. The master suite is separate from the smaller bedrooms, allowing needed privacy between the different users of the house. Further, the master suite could function as an office or den for a smaller household.

## Hierarchy and Outdoor spaces

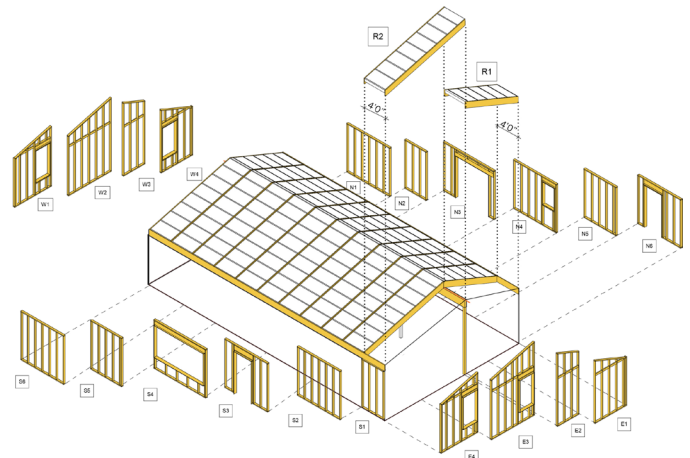
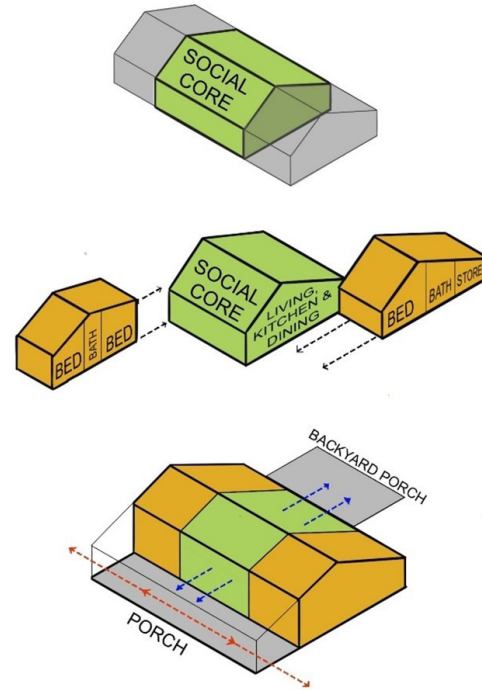
A clear connection, both visual and physical, between the inside and outside creates an opportunity to occupy multiple indoor and outdoor spaces without the feeling of complete separation. A hierarchy of spaces is maintained by transitioning from street to porch and into the central space then to the more private spaces of the home.

## Simple form

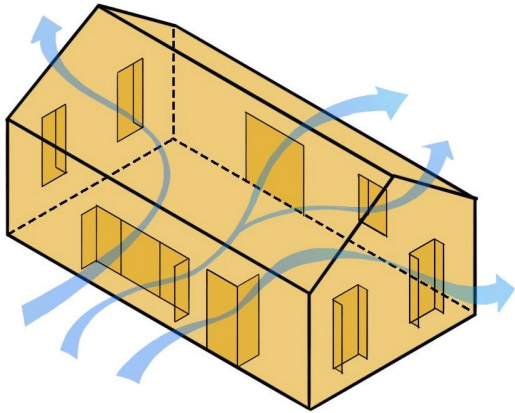
The compact form provides opportunities for natural light and ventilation with an economical number of windows. The orientation of the house provides opportunities for entry from either the east and west ends, and promotes security by providing 'eyes' to the outdoor surroundings via the covered porch space and rear patio.

## Modularity and Repetition

The house is dimensioned to maximize the use of 4ft. wide structural insulated panel (SIP) modules, providing ease of construction, reduction and improved control of project costs, more efficient use of labor, and decreased material waste.

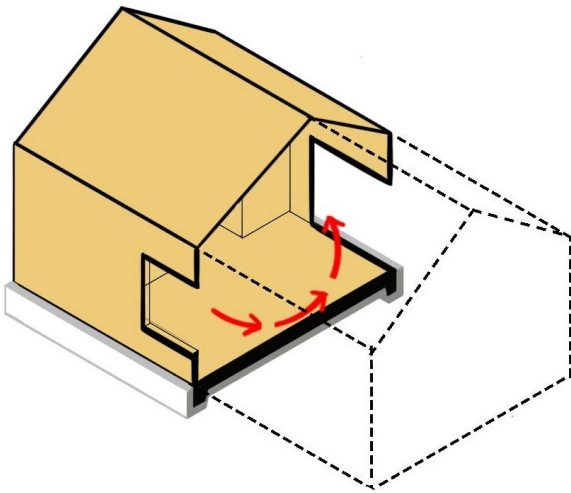


## STRATEGY



### Passive Cooling: Cross Ventilation

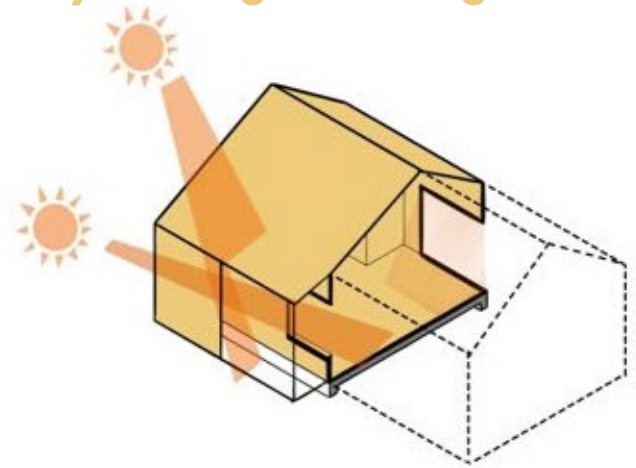
2 mph + wind greatly reduces need for A/C



### Passive Solar Heating: Thermal Mass Floor

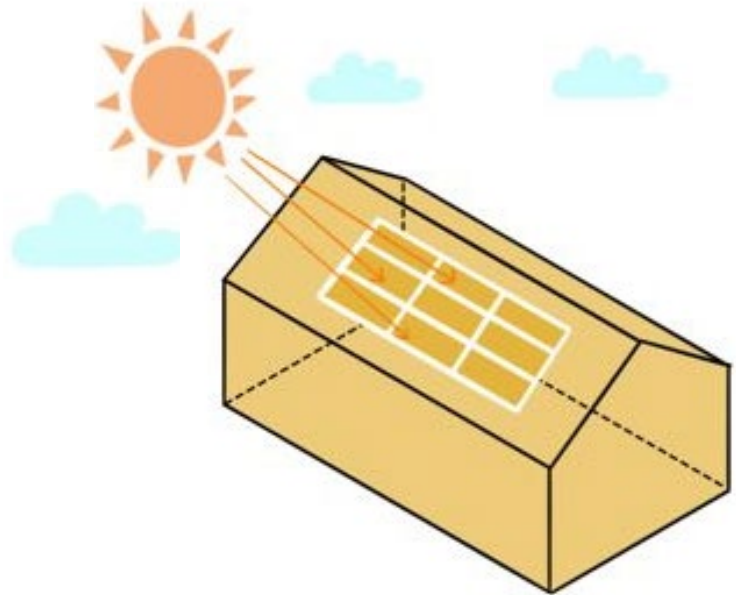
Sun heats concrete mass floor for reduced heating needs

Energy simulations predict **1/3** of the year, the house would not require any heating or cooling.



### Passive Solar: Daylighting and Shading

Blocking high summer sun and allowing low winter sun reduces energy and lighting loads



### Solar Energy

Clear skies promote effectiveness of solar energy production



# FINAL DESIGN

## Built Positive

Living in a smaller town often means a greater reliance on the home as a social and active space. The prototype home delivers by providing a clear connection to outdoors, while using high ceilings and carefully designed custom casework to make the interior of the house more functional and airy.

As a whole, the prototype home for St. John shows how a small, affordable, highly efficient house can offer something truly positive for its occupants, creating the opportunity to turn a house into a home.





PLANS





